



## General

### Guideline Title

Prehospital cervical spinal immobilization after trauma. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

### Bibliographic Source(s)

Theodore N, Hadley MN, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, Rozzelle CJ, Ryken TC, Walters BC. Prehospital cervical spinal immobilization after trauma. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):22-34. [109 references] [PubMed](#)

### Guideline Status

This is the current release of the guideline.

## Recommendations

### Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

#### Recommendations

##### Level II

Spinal immobilization of all trauma patients with a cervical spine or spinal cord injury or with a mechanism of injury having the potential to cause cervical spinal injury is recommended.

- Triage of patients with potential spinal injury at the scene by trained and experienced emergency medical services (EMS) personnel to determine the need for immobilization during transport is recommended.
- Immobilization of trauma patients who are awake, alert, and are not intoxicated; who are without neck pain or tenderness; who do not have an abnormal motor or sensory examination; and who do not have any significant associated injury that might detract from their general evaluation is not recommended.

##### Level III

- A combination of a rigid cervical collar and supportive blocks on a backboard with straps is effective in limiting motion of the cervical spine and is recommended.
- The longstanding practice of attempted spinal immobilization with sandbags and tape is insufficient and is not recommended.

- Spinal immobilization in patients with penetrating trauma is not recommended because of increased mortality from delayed resuscitation.

## Summary

Spinal immobilization can reduce untoward movement of the cervical spine and can reduce the likelihood of neurological deterioration in patients with unstable cervical spinal injuries after trauma. Immobilization of the entire spinal column is necessary in these patients until a spinal cord injury (or multiple injuries) has been excluded or until appropriate treatment has been initiated. Although immobilization of the cervical spine after trauma is not supported by Class I or II medical evidence, this effective, time-tested practice is based on anatomic and mechanical considerations in an attempt to prevent spinal cord injury and is supported by years of cumulative trauma and triage clinical experience.

Not all trauma patients must be treated with spinal immobilization during prehospital resuscitation and transport. Many patients do not have spinal injuries and therefore do not require such intervention. The development of specific selection criteria for those patients for whom immobilization is indicated remains an area of investigation. Current publications on the use of contemporary, well-defined EMS triage protocols provide Class II medical evidence for their utility.

The variety of techniques used and the lack of definitive evidence to advocate a uniform device for spinal immobilization make immobilization technique and device recommendations difficult. It appears that a combination of a rigid cervical collar with supportive blocks on a rigid backboard with straps and tape to immobilize the entire body is effective at achieving safe, effective spinal immobilization for transport. The longstanding practice of attempted spinal immobilization with sandbags and tape with the patient strapped to a rigid backboard is not sufficient and is not recommended.

Cervical spine immobilization devices are effective but can result in patient morbidity. Spinal immobilization devices should be used to achieve the goals of spinal stability for safe extrication and transport. They should be removed as soon as a definitive evaluation is accomplished and/or definitive management is initiated. Spinal immobilization of trauma patients with penetrating injuries is not recommended.

## Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question<sup>a</sup>

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{A}$ , statistic $\geq 0.60$ or an intraclass correlation coefficient of $\geq 0.70$
	Systematic review <sup>b</sup> of Class I randomized controlled trials (and study results were homogeneous <sup>c</sup> )	Systematic review <sup>b</sup> of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{A}$ , statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective <sup>d</sup> comparative study <sup>e</sup>	Systematic review <sup>b</sup> of Class II studies	
	Systematic review <sup>b</sup> of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study <sup>g</sup>	Systematic review <sup>b</sup> of Class III	

Class	Therapeutic Studies: Investigating the Results of Treatment <sup>f</sup>	Diagnostic Studies: Investigating the Diagnostic Test <sup>g</sup>	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
	Systematic review <sup>b</sup> of Class II studies		
III	Case series <sup>h</sup>	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{\kappa}$ statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

<sup>a</sup>A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

<sup>b</sup>A combination of results from 2 or more prior studies.

<sup>c</sup>Studies provided consistent results.

<sup>d</sup>Study was started before the first patient enrolled.

<sup>e</sup>Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

<sup>f</sup>The study was started after the first patient was enrolled.

<sup>g</sup>Patients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

<sup>h</sup>Patients treated 1 way with no comparison group of patients treated in another way.

#### Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

## Clinical Algorithm(s)

None provided

## Scope

## Disease/Condition(s)

Acute cervical spine and spinal cord injuries

## Guideline Category

Management

## Clinical Specialty

Emergency Medicine

Neurological Surgery

Neurology

Orthopedic Surgery

## Intended Users

Advanced Practice Nurses

Emergency Medical Technicians/Paramedics

Hospitals

Nurses

Physician Assistants

Physicians

## Guideline Objective(s)

- To help clinicians make important decisions in the care of prehospitalized patients requiring cervical spinal immobilization after trauma
- To update the medical evidence on spinal immobilization since the previous publication

## Target Population

Trauma patients with potential cervical spine and spinal cord injuries

## Interventions and Practices Considered

1. Prehospital cervical spinal immobilization following triage to determine need for immobilization
2. Use of a combination rigid cervical collar and supportive blocks on a backboard with straps
3. Immobilization with sandbags and tape (not recommended)

## Major Outcomes Considered

- Mortality rate
- Overall survival
- Effectiveness of immobilization techniques in limiting motion
- Morbidity associated with immobilization devices

## Methodology

## Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

## Description of Methods Used to Collect/Select the Evidence

### Search Criteria

A National Library of Medicine computerized literature search from 1966 to 2011 was conducted with the terms "spinal injuries" and "immobilization." The search was limited to human subjects and the English language and yielded no articles. A second search combining the terms "spinal injuries" and "transportation of patients" yielded 81 articles. A third search combining the terms "spinal injuries" and "emergency medical services" produced 331 articles. Additional references were culled from the reference lists of the remaining papers. Finally, the author group was asked to contribute articles known to them on the subject matter that were not found by other search criteria. Duplicate references were discarded. The abstracts were reviewed and articles unrelated to the specific topic were eliminated. This process yielded a total of 109 articles for this review, which are listed in the bibliography in the original guideline document.

## Number of Source Documents

Thirty pertinent publications are included in the evidentiary table (refer to the table in the original guideline document).

## Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

## Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question<sup>a</sup>

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
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	Systematic review <sup>b</sup> of Class I randomized controlled trials (and study results were homogeneous <sup>c</sup> )	Systematic review <sup>b</sup> of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{\kappa}$ statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective <sup>d</sup> comparative study <sup>e</sup>	Systematic review <sup>b</sup> of Class II studies	

Class	Systematic Review <sup>b</sup> of Class II studies Results of Studies with inconsistent results	Diagnostic Studies Investigating Patients with Consistently Applied reference "gold" standard	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
	Case-control study <sup>g</sup>	Systematic review <sup>b</sup> of Class III studies	
	Retrospective <sup>f</sup> comparative study <sup>e</sup>	Case-control study	
	Systematic review <sup>b</sup> of Class II studies		
III	Case series <sup>h</sup>	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\kappa$ statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

<sup>a</sup>A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

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<sup>h</sup>Patients treated 1 way with no comparison group of patients treated in another way.

## Methods Used to Analyze the Evidence

### Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to the table in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

# Methods Used to Formulate the Recommendations

Expert Consensus

## Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

## Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

Not stated

## Description of Method of Guideline Validation

Not applicable

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

A more uniform, universally accepted method for prehospital spinal immobilization for patients with potential spinal injury after trauma may reduce the cost and improve the efficiency of prehospital spinal injury management.

## Potential Harms

- Cervical spinal immobilization has a few potential drawbacks. Immobilization can be uncomfortable; it can be difficult to apply properly; it takes time to apply; application may delay transport; and it is associated with modest morbidity.
- Morbidity is more likely to occur when concomitant head injury exists, in patients with ankylosing spondylitis, and in the setting of delayed resuscitation.
- Refer to the "Safety of Prehospital Spinal Immobilization" section in the original guideline document for more information.

## Qualifying Statements

### Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.
- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

### Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Getting Better

### IOM Domain

Effectiveness

Timeliness



# Identifying Information and Availability

## Bibliographic Source(s)

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## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

2013 Mar

## Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

## Source(s) of Funding

Congress of Neurological Surgeons

## Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

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## Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

## Guideline Status

This is the current release of the guideline.

## Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the [Neurosurgery Web site](#)

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## Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the [Neurosurgery Web site](#) .
- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

## Copyright Statement

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